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Canadian Environmental Sustainability Indicators

Metal mining effluent quality

Canada

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Metal mining effluent quality

May 2018

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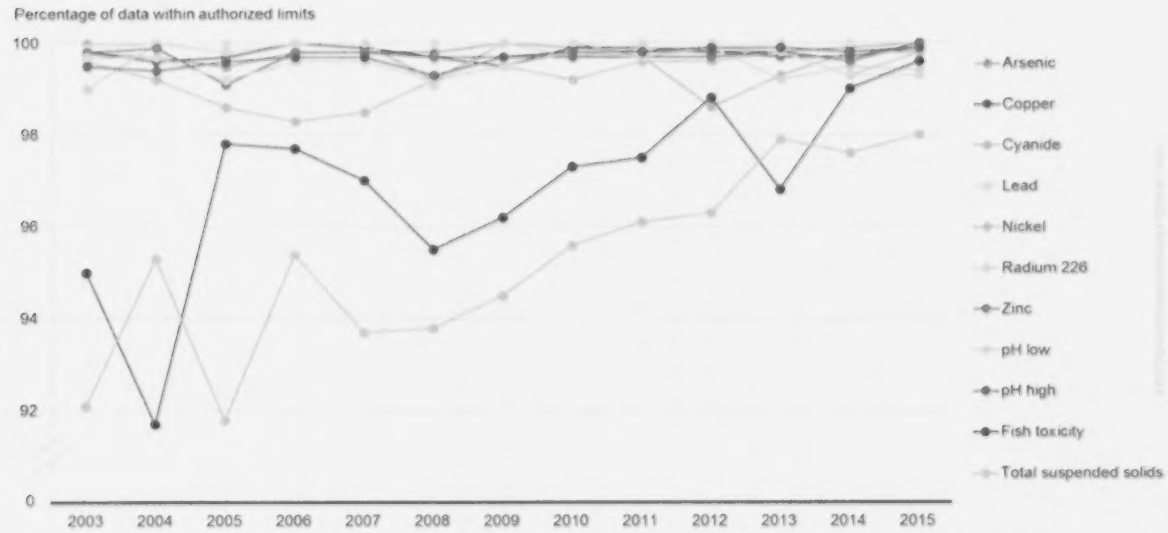
Metal mining effluent quality

The effects of untreated mining effluent could be highly damaging to aquatic environments. The Metal Mining Effluent Regulations are designed to protect fish and fish habitat by governing the discharge of effluent into water frequented by fish. The indicator summarizes the test results observed since the regulations came into effect.

Key results

- Between 2003 and 2015, the percentage of mining operations meeting regulatory standards for total suspended solids increased from 92.1% to 98%. The fish toxicity test also showed an increase in compliance from 95% to 99.6%.
- Test results for all other deleterious substances and pH levels ranged from 98.3% to 100% compliance over this time period.

Figure 1. Percentage of regulatory data submitted by metal mines within authorized limits, Canada, 2003 to 2015



Data for Figure 1

Note: Deleterious substances listed in the Metal Mining Effluent Regulations include arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids, and radium 226. The regulations set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Fish toxicity refers to tests of effluent on rainbow trout mortality rate.
Source: Environment and Climate Change Canada (2017) Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2015.

The regulations came into effect on June 6, 2002. They apply to all Canadian metal mines that have an effluent flow rate exceeding 50 cubic metres per day, and that deposit a deleterious substance in any water or place defined in the regulations. The regulations define metal mines as hydrometallurgical, milling or mining facilities that are designed or used to produce a metal, a metal concentrate, or an ore from which a metal or metal concentrate may be produced. The definition also includes smelters, pelletizing plants, sintering plants, refineries, acid plants and other facilities where any effluent is combined with the effluent from hydrometallurgy, milling or mining.

Mining operations that are not captured under the regulations include placer mines,[1] coal mines, diamond mines, quarries, and other non-metallic mineral mining facilities. These mines are still subject to the requirements of the Fisheries Act, including the general prohibition on the deposit of deleterious substances.

About the indicator

What the indicator measures

The Metal mining effluent quality indicator presents the annual percentage of reported results for deleterious substances, pH levels and acute lethality tests within authorized limits from 2003 to 2015. The indicator helps Environment and Climate Change Canada evaluate the degree of compliance with the regulations and the effectiveness of pollution prevention and control technologies, practices and programs within the metal mining sector. This indicator summarizes the results achieved since the Metal Mining Effluent Regulations came into effect in June 2002.

Why this indicator is important

Metal mining is an important sector for the Canadian economy. In 2015, the metal ore mining industry employed 40 400 Canadians,[2] and accounted for 1.24% of Canada's gross domestic product.[3] Canada ranks among the top 5 countries in terms of the production of a number of major metals.[4,5]

Without adequate regulations, metal mining could have harmful impacts on the environment. For example, the effects of untreated mining effluent could be highly damaging to aquatic environments, fish and fish habitat. Proper management regimes can mitigate these impacts. These regulations are designed to protect fish and fish habitat by setting standards for effluent released from metal mines into the environment. Specifically, the regulations prohibit discharge of effluent which is acutely lethal to fish and set limits for pH of effluent and concentrations of arsenic, copper, cyanide, lead, nickel, zinc, radium 226 and total suspended solids.

Related indicator

The Managing pulp and paper effluent quality indicator summarizes the degree of compliance achieved since 1985 under the Pulp and Paper Effluent Regulations.

Pristine lakes and rivers

This indicator supports the measurement of progress towards the following 2016–2019 Federal Sustainable Development Strategy long-term goal: Clean and healthy lakes and rivers support economic prosperity and the well-being of Canadians.

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[1] Placer mines are mining operations that extract minerals or metals from stream sediments by gravity or magnetic separation.

[2] Statistics Canada, Table 383-0031 - Labour statistics consistent with the System of National Accounts (SNA), by province and territory, job category and North American Industry Classification System (NAICS), for the metal ore mining industry (NAICS 2122). Retrieved on January 24, 2018.

[3] Statistics Canada, Table 379-0031 - Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), for the metal ore mining industry (NAICS 2122) (2007 constant million dollars). Retrieved on January 24, 2018.

[4] In 2015, Canada was the second-largest producer of uranium and nickel, and the third-largest producer of cobalt and platinum group metals.

[5] Mining Association of Canada (2017) Facts and Figures of the Canadian Mining Industry 2016. Retrieved on January 24, 2018.

Data sources and methods

Data sources

This indicator uses monthly mean compliance data provided by metal mines to Environment and Climate Change Canada under section 22 of the Metal Mining Effluent Regulations (the regulations). Since 2004, Environment and Climate Change Canada has made the data available through the annual release of the Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2015.

More information

This indicator uses data from all metal mines subject to the regulations. Table 1 presents the number of such mines by province and territory from 2003 to 2015.

Table 1. Number of metal mines subject to the regulations by jurisdiction, 2003 to 2015

Province or territory	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Newfoundland and Labrador	3	3	5	5	5	6	6	6	8	9	10	10	11
Prince Edward Island	0	0	0	0	0	0	0	0	0	0	0	0	0
Nova Scotia	0	0	0	0	1	1	1	1	1	1	1	1	1
New Brunswick	1	1	1	1	3	3	3	3	3	3	3	3	3
Quebec	20	21	21	26	28	30	31	28	28	31	32	33	34
Ontario	21	21	22	25	28	29	31	34	37	38	40	40	45
Manitoba	9	9	9	8	9	10	10	10	11	10	10	10	10
Saskatchewan	8	8	8	8	8	8	8	7	7	9	9	9	8
Alberta	0	0	0	0	0	0	0	0	0	0	0	0	0
British Columbia	5	5	5	5	6	6	8	9	10	8	8	12	11
Yukon	0	0	0	1	1	1	2	2	3	3	3	3	3
Northwest Territories	3	3	3	3	3	3	3	3	2	3	3	3	3
Nunavut	3	3	3	3	2	1	1	2	2	2	2	2	3
Canada	**73**	**74**	**77**	**85**	**94**	**98**	**104**	**105**	**112**	**117**	**121**	**126**	**132**

The monthly data come from quarterly and annual reports of metal mine effluent discharges submitted to Environment and Climate Change Canada under the regulations since they came into force on June 6, 2002, replacing and expanding the scope of the 1977 Metal Mining Liquid Effluent Regulations. It includes all monthly mean compliance data derived from sampling results submitted to Environment and Climate Change Canada between 2003 and 2015.

Methods

The indicator is calculated by measuring the percentage of test results for all metal mines that are within authorized limits for deleterious substances, pH levels and fish toxicity. For each substance, this is done by dividing the number of monthly mean results that meet the authorized limits by the total number of monthly mean results reported in a given year.

More information

The regulations include provisions to allow the discharge of metal mine effluent into water frequented by fish, subject to certain requirements. Mines that are subject to the regulations may deposit an effluent that contains a deleterious substance if:

- the concentration of the deleterious substance in the effluent does not exceed the authorized limits
- the pH of the effluent is equal to, or greater than, 6.0 but is not greater than 9.5
- the effluent is not acutely lethal (an effluent is deemed non-acutely lethal if it kills less than 50% of the rainbow trout subjected to it at 100% concentration over a 96-hour period)

For deleterious substances, individual test results for each substance are compared with the maximum authorized concentration in a grab sample set out in the regulations. All the test results in a month for each substance are used to calculate monthly mean concentrations for each final discharge point. These monthly means are compared to the maximum authorized monthly mean concentration limits set out in the regulations. Table 2 summarizes the maximum authorized monthly mean concentrations, in milligrams per litre or in becquerels per litre, for the deleterious substances listed in the regulations.

The frequency of test measurements varies depending on the individual mine and its performance. Under the regulations, operators are required to test the effluent at each discharge point weekly for deleterious substances and monthly for acute lethality (fish toxicity) and to record the results of all tests.

The frequency of testing can be reduced to once per quarter in the following instances:

- for arsenic, copper, cyanide, lead, nickel and zinc: if the concentration of the substance from a discharge point is less than 10% of the regulations monthly mean concentration limit for that substance over a period of 12 consecutive months
- for radium 226 from metal mines, other than uranium mines: if the concentration of radium 226 is less than 0.037 becquerel per litre in 10 consecutive tests
- for fish toxicity: if the effluent is determined not to be acutely lethal over a period of 12 consecutive months

Table 2. Authorized limits for deleterious substances

Substances	Maximum authorized monthly mean concentration
Arsenic	0.50 milligram per litre
Copper	0.30 milligram per litre
Cyanide	1.00 milligram per litre
Lead	0.20 milligram per litre
Nickel	0.50 milligram per litre
Zinc	0.50 milligram per litre
Total suspended solids	15.00 milligrams per litre

Substances	Maximum authorized monthly mean concentration
Radium 226	0.37 becquerel per litre

Note: Concentration limits are 1 of the 3 types of limits included in the regulations, the others being the maximum authorized concentration in a composite sample and the maximum authorized concentration in a grab sample. More information about these limits is available in Schedule 4 of the regulations.
Source: Fisheries and Oceans Canada (2017) Metal Mining Effluent Regulations.

Recent changes

A total of 33 mines in Quebec were subject to the regulations in 2014, not 32, as was previously reported. Table 1 has been updated accordingly.

Caveats and limitations

The data were compiled by staff of the Mining Section of Environment and Climate Change Canada using the effluent quality information provided by the metal mines in their submitted annual reports. In some cases, Environment and Climate Change Canada staff used quarterly reports to complete information that was missing or not properly reported by the owners or operators of some mines.

Resources

References

Environment and Climate Change Canada (2017) Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2015. Retrieved on January 24, 2018.

Fisheries and Oceans Canada (2012) Regulations Amending the Metal Mining Effluent Regulations. Canada Gazette, Part II. March 2, 2012. Queen's Printer for Canada. Retrieved on January 24, 2018.

Related information

Assessment of the Aquatic Effects of Mining in Canada: AQUAMIN Final Report (PDF; 459 kB)

National assessment of phase 1 data from the Metal Mining Environmental Effects Monitoring Program

Second national assessment of environmental effects monitoring data from metal mines

Metal Mining Effluent Regulations

Annex

Annex A. Data table for the figure presented in this document

Table A.1. Data for Figure 1. Percentage of regulatory data submitted by metal mines within authorized limits, Canada, 2003 to 2015

Type of test	2003 (percentage)	2004 (percentage)	2005 (percentage)	2006 (percentage)	2007 (percentage)	2008 (percentage)	2009 (percentage)	2010 (percentage)	2011 (percentage)	2012 (percentage)	2013 (percentage)	2014 (percentage)	2015 (percentage)
Arsenic	99.8	99.7	99.5	99.8	99.8	99.8	100.0	99.9	99.8	99.8	99.8	99.9	100.0
Copper	99.8	99.6	99.7	100.0	99.9	99.7	99.5	99.9	99.9	99.8	99.7	99.7	99.9
Cyanide	100.0	100.0	100.0	100.0	100.0	99.2	100.0	100.0	99.7	98.6	99.3	99.8	99.8
Lead	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Nickel	99.6	99.2	98.6	98.3	98.5	99.2	99.5	99.2	99.6	99.6	99.8	99.3	99.8
Radium 226	99.0	100.0	99.8	100.0	100.0	99.1	100.0	99.7	99.9	99.9	99.2	99.5	99.4
Zinc	99.8	99.9	99.1	99.8	99.8	99.7	99.7	99.7	99.7	99.7	99.8	99.6	100.0
pH low	99.7	99.7	99.2	99.6	99.6	99.2	99.5	99.8	99.7	99.9	99.8	99.3	99.3
pH high	99.5	99.4	99.6	99.7	99.7	99.3	99.7	99.8	99.8	99.9	99.9	99.8	99.9
Fish toxicity	95.0	91.7	97.8	97.7	97.0	95.5	96.2	97.3	97.5	98.8	96.8	99.0	96.3
Total suspended solids	92.1	95.3	91.8	95.4	93.7	93.8	94.5	95.6	96.1	96.3	97.9	97.6	98.0

Note: Deleterious substances listed in the Metal Mining Effluent Regulations include arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids, and radium 226. The regulations set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Fish toxicity refers to tests of effluent on rainbow trout mortality rate.
Source: Environment and Climate Change Canada (2017) Status report on the performance of metal mines subject to the Metal Mining Effluent Regulations in 2015.

Additional information can be obtained at:

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